Profile and function of green open space vegetation in Malang

Sumardi Basri[1], Amin Setyo Leksono[2*], Bagyo Yanuwiadi[2]

[1]Forestry Study Program, Faculty of Forestry, Malang Institute of Agriculture, Indonesia
[2]Departments of Biology, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya, Indonesia
[2]Faculty of Agriculture, Universitas Brawijaya, Indonesia

Abstract- Green open space is the areas developed to serve function as food, shade, protection, aesthetic and culture which is the main function to support the green city. The purpose of this study is to compare the profile and function of green open space in the city of Malang. This research was conducted in four green open spaces in Malang, East Java, Indonesia. Three of those were located in municipal areas as follow Veterans Green Belt (VGB), Jakarta Green Belt (JGS), Velodrome Green Space (VGS); while a study site was selected in a Permata Jingga Neighborhood Space (PNS), Neighborhood or resident area. Green space profile was analyzed by vegetation analysis indices including density, species richness and diversity. Green space function was assessed by interviews with informants. The level of density of green open space trees in Malang ranges from 505 to 1046 per hectare. The highest species richness, species diversity, and indigenous index found in VGS then followed by JBG. The high species richness, species diversity, and indigenous indices in Velodrome are related to the shape of green space. The VGS is square while the other has a belt shape. Rectangle shape allows various types to grow in green space. The green spaces serve as shelter, protection, food, medicine, and aesthetic. Of the several types assessed, some species have a high enough use value. Avocados and manga were categorized as having a high utilization index as foods. Pine was considered to have a high medicinal use value. Gamhar, Palm oil, Mahogany, and Jackfruit have a high shading index. The Cockspur coral tree, Palm princess, Cuban royal palm and the Bottle brush have a high index of use to support the aesthetics of city parks, while Gamhar, mahogany, and Jackfruit use a high protection index.

Key words-biodiversity, city park, function, conservation, vegetation

I. INTRODUCTION

The importance of urban green open space has been demonstrated in several studies [1]. Urban green open space is an important component that determines the quality of human life, both ecologically and socially-psychologically. The open green space is a meeting between natural and human systems in an urban environment. Urban green spaces, such as parks, forests, green roofs, streams, and community gardens, provide important ecosystem services. Green spaces also support physical activity, psychological well-being, and the health of the city's general public.

Green Space plays an important role in supporting urban ecological and social systems, a fact which supports public commitments in Britain and Europe. The amount of supply, distribution of green space, and access to that space are the main contributors to social and ecological functions in the urban environment The development of Malang City has gone out of its original plan. Malang city. Change the same changes. Being a green open space (GOS) is a developed area [2]. Open space is a space that can be accessed by the public within a limited and indefinite period of time. Green open spaces can be built, walkways, city parks and urban forests. The minimum green space area of 30% is the minimum size of vegetated area to provide a balanced ecosystem of the area.

Green open spaces can control growth and maintain green areas, recreational areas or embracing. Guidelines are applied, effectively helping to save global effects and climate change in Indonesia. The concept offered by green developers is no more than a marketing strategy. Developers often associate the concept of green living with trees, plants, or the color of green. The most basic element of the Green City ecosystem is the main vegetation of trees; vegetation remains a balance of ecosystems in residential areas. Ecosystem elements that must remain balanced are hydrological function, microclimate, clean air and carbon dioxide, regulate environmental health, and synergize the natural and artificial environment.

Plant cultivation on the median road not only functions as aesthetics, but also has a functional value that can improve the function of the median road as a shade, a protector for road users. Therefore, species selection and plant management in the road median must be in accordance with the criteria for physical characteristics, plant ecology, road approval, and regulation for the road median [3].

The smart green city initiative is a combination of the concept of smart and green city in certain strategic areas. The background to this publication is the rapid growth of cities and various problems such as traffic jams, floods, landslides, slums, social gathering, and reducing the amount of green open space. In recent years, the region's problems

have become more severe because climate change requires people living in cities to think more carefully. Important to develop. These become policies and programs that are more challenging and responsive to change. The realization of smart and green cities as sustainable metaphor cities, according to the application of the principles of sustainable development, as well as providing urban needs and problems, as well as the challenges of climate change. The declining quality of settlements in urban areas can be seen from the increasingly severe congestion, the development of slums that are vulnerable to flooding, as well as the loss of green space for articulation and public health. The purpose of this study is to compare the profile and function of green open space in the city of Malang.

II.   MATERIAL AND METHOD

This research was conducted in four green open spaces in Malang, East Java, Indonesia. Three of those were located in municipal areas as follows Veterans Green Belt (VGB), Jakarta Green Belt (JGS), Velodrome Green Space (VGS); while a study site was selected on a Permata Jingga Neighborhood Space (PNS), Neighborhood or resident area (Figure 1).
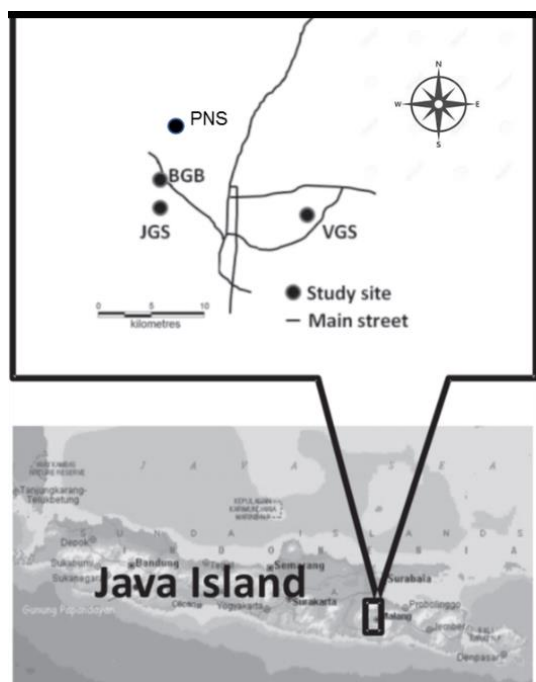

Figure 1. Map of study site in four green spaces in Malang, East Java, Indonesia [4]

The study would conduct comprehensive evaluation and analysis towards the following aspects, namely types and composition of vegetation, convenience index, landscape vegetation cover index, and green open space ecosystem. The logic model method for analyzing vegetation composition using quantitative method is used to run statistical analysis on the type and composition of vegetation, vegetation cover index towards objects found in green open space which involves green open space ecosystem (landscape). Vegetation function was analyzed using qualitative data from informants. The informants

consisted of 15 persons of vegetation expert. This analysis would result in the relationship between type of vegetation, and function as the elements of the smart green city.

III. RESULT AND DISCUSSION

The results of this study indicate that the level of density of green open space trees in Malang ranges from 505 to 1046 per hectare. The highest species richness, species diversity, and indigenous index found in VGS then followed by JBG (Table 1). The high species richness, species diversity, and indigenous indices in Velodrome are related to the shape of green space. The VGS is square while the other has a belt shape. Rectangle shape allows various types to grow in green space.

Table 1. Green space species density and diversity among four study sites

No	VGB	JGB	VGS	PNS
Density (ind./ha)	505	607	1046	668
Number of species	28	38	46	29
Species diversity	2.23	2.91	3.05	2.85
Indigenous index	0.36	0.47	0.55	0.45

VGS consists of Narra (*Pterocarpus indicus*), Plam oil (*Elaeis guineensis*), Cockspur coral tree (*Erythrina crista galli*), Red Condo (*Mimusops elengi*), Platycladus (*Thuja orientalis*). The JGS consists of Mahogany (*Swietenia mahagoni* Jacq), Gamhar (*Gmelina arborea*), fountain tree (*Spathodea campanulata*), Mango (*Mangifera indica*), Avocado (*Persea americana*). The VGS Guanacaste (*Enterolobium cyclocarpum*), Butterfly Tree (*Bauhinia purpurea*), Gamhar (*Gmelina arborea*), Butterfly Tree (*Bauhinia purpurea*), Guanacaste (*Enterolobium cyclocarpum*), while the PNS consists of Rain Tree (*Samanea saman*), Plam oil (*Elaeis guineensis*), trees, silver date palm, (*Phoenix silvestris*) and cockspur coral tree (*Erythrina crista galli*).

Based on interviews with respondents the green spaces serve as shelter, protection, food, medicine, and aesthetic (Table 2). Of the several types assessed, some species have a high enough use value. Avocados and manga were categorized as having a high utilization index as foods. Pine was considered to have a high medicinal use value. Gamhar, Palm oil, Mahogany, and Jackfruit have a high shading index. The Cockspur coral tree, Palm princess, Cuban royal palm and the Bottle brush have a high index of use to support the aesthetics of city parks, while Gamhar, mahogany, and Jackfruit use a high protection index (Table 2).

Table 2. Respondent perception on vegetation on the utility value of green space plant species

Local (scientific name	Sha.	Pro.	Food	Med.	Soc. Aes.
Avocado (*Persea Americana)*	M	m	H		
giant crepe-myrtle (*Lagerstromeia speciosa*)	M	l		L	M
Platycladus (*Thuja orientalis*)	L	L			M
Norfolk pine (*Araucaria heterophylla*)	L				M
cockspur coral tree (*Erythrina crista-galli*)	L	M		L	H
Flamboyan (*Delonix regia*)	M	M		L	H
Gamhar (*Gmelina arborea*)	H	H		*M*	
The false ashoka (*Polyalthia longifolia*)	M				M
Palm oil (*Elaeis guineensis*)	H		M	L	M
Fern Tree (*Fillicium desipiens*)	M	M		L	M
Mahogany (*Swietenia mahagoni* Jacq)	H	H		M	L
Mango (*Mangifera indica*)	M	M	H	L	
Jackfruit (*Artocarpus heterophyllus*)	H	H	M	L	
Palm princess (*Veitchia merillii*)	L				H
Cuban royal palm (*Roystone regia*)	M	M			H
Pine (*Pinus merkusii*).	L			H	M
Kapok (*Ceiba petandra*)	M	L			
Guanacaste (*Enterolobium cyclocarpum*)	M	L		L	
The Crimson Bottlebrush (*Callistemon citrinus*)	L	L			H
Narra (*Pterocarpus indicus)*	M	M		L	
fountain tree (*Spathodea campanulate)*	M	M		L	M
Red Condo (*Mimusops elengi*)	M	M		L	M
Rain Tree (*Samanea saman*)	M	M		L	M

Note: *Sha. = shading, Pro. =protection, Med.= medicine, Soc. Aes. = social and aesthetic, H = high, M = medium, L = low*

Green open spaces can be categorized as spaces where plants grow and are useful, and the types of plants that are planted in green space are trees, shrubs, shrubs, vines and herbaceous plants. Open space has the power to shape the status of a city's character, social interaction and maintain the quality of its environment. Green space landscape is a man-made landscape as a result of human activities in managing the environment to meet their needs [5]. Green open spaces can take the form of roads, walkways, city parks, and urban forests. The minimum green space area of 30% is the minimum size of vegetated area to ensure the balance of the area's ecosystem. The ecosystem balance that is maintained is the hydrological function, the microclimate, the availability of clean air so that it can be guaranteed for the needs of its citizens and the absorption of carbon dioxide. In addition, vegetated areas can increase the aesthetic value of the area [6]. In addition, green space is also an important part of the conservation of biological resources of the local ecosystem and is also developed to maintain the quality of indigenous plants and environmental sustainability. This is expected to support the idea of the smart green city in Malang City. The results of this study indicate that the development of vegetation composition as supporting elements of green open space illustrates the composition of balanced vegetation. Most of the green open space in the area also functions as a park or road divider.

In addition to ecological functions, the function of green space has been recognized as a social and aesthetic function. City Park is a place to get a cool, fresh, calm and beautiful atmosphere for urban communities, including young people. City Park has become a community need for facilities that are used as aesthetic solutions and recreation areas, both children's groups, adolescents [7] older adults. Teenagers and children admit that they enjoy beauty and use various facilities in the city park, which is located close to their school [8]. Children and adolescents enjoy playing, walking on small bridges, climbing trees, and some obstacles such as shrubs because their activities in the environment and garden can enhance their aesthetic fantasy [9]. In addition, green space also supports behaviors important for physical activity [10]. The presence of large amounts of green space with good access in walking distance was found to be associated with more physical activity in the form of walking [11-13]. More recent studies have shown a positive relationship with physical activity in various forms, including sports, gardening, walking and cycling [13-14].

IV. CONCLUSION

The level of density of green open space trees in Malang ranges from 505 to 1046 per hectare. The highest species richness, species diversity, and indigenous index found in VGS then followed by JBG. The high species richness, species diversity, and indigenous indices in Velodrome are related to the shape of green space. The VGS is square while the other has a belt shape. Rectangle shape allows various types to grow in green space.

The green spaces serve as shelter, protection, food, medicine, and aesthetic. Of the several types assessed, some species have a high enough use value. Avocados and manga were categorized as having a high utilization index as foods.

Pine was considered to have a high medicinal use value. Gamhar, Palm oil, Mahogany, and Jackfruit have a high shading index. The Cockspur coral tree, Palm princess, Cuban royal palm and the Bottle brush have a high index of use to support the aesthetics of city parks, while Gamhar, mahogany, and Jackfruit use a high protection index.

ACKNOWLEDGEMENT

REFERENCES

[1] J. Wu. Urban sustainability: an inevitable goal of landscape research. 2009. Landscape Ecol, pp 25: 1–4.

[2] S. Niti, E.B. Kurniawan, and M. Anggraeni, Optimasi Hutan Sebagai Penghasil Oksigen Kota Malang. 2011. Jurnal Tata Kota dan Daerah. 3, 1.

[3] A. S.Leksono, A. R. K. Nisa, L. Kurniawan and N. A. Normalitasari. Diversity and composition of butterfly visitors of green spaces in Malang dan Pasuruhan, East Java, Indonesia. 2016. 22, 3, pp: 1165-1169.

[4] D. P. A. Nurfathya, E. E. Nurlalelih dan Sitawati. Evakuasi Pemilihan Jenis dan Penataan Tanaman Median Jalan Kota Malang. 2015. Jurnal Produksi Tanaman, 3, 4, Juni, pp. 269 –277

[5] J. O. Simonds, dan B. W. Starke. (2006). Landscape Architecture. New. York: McGraw-Hill Companies. 396.

[6] A. Baharudin, Kebutuhan Ruang Terbuka Hijau Pada Kawasan Pusat Kota Jayapura. 2011. Jurnal Bumi Lestari, 11, 2 pp: 297-305.

[7] R. Hakim, 2009. Ruang Terbuka dan Ruang Terbuka Hijau, http//:rustam2000.wordpress.com/ruang-terbuka-hijau

[8] R, Moore. Appreciating Natural Beauty as Natural, Journal of Aesthetic. 2008. Education, 33; 42-59.

[9] I. Fjortoft, Landscape as Playscape : The Effects of Natural Environments on Children`s Play and Motor Development. The International Journal of Children, Youth and Environments. 2004. Faculty of Arts,Folk Culture and Teacher Education Norway; 04-19

[10] A. T. Kaczynski, L. R. Potwarka, B. E. Saelens Association of park size, distance, and features with physical activity in neighborhood parks. Am J Public Health. 2008, 98 (8): 1451-1456.

[11] B, Giles-Corti, M. H. Broomhall, M. Knuiman, C. Collins, K. Douglas, A. Lange, R. J. Donovan. Increasing walking: how important is distance to, attractiveness, and size of public open space?. 2005. Am J Prev Med., 28 (Supplement 2): 169-176.

[12] M. J. Koohsari, J. A. Karakiewicz, A. T. Kaczynski. Public open space and walking: the role of proximity, perceptual qualities of the surrounding built environment, and street configuration. 2013, Environ Behav. 45 (6): 706-736.

[13] E. Coombes, A. P. Jones, M. Hillsdon. The relationship of physical activity and overweight to objectively measured green space accessibility and use. 2010, Soc Sci Med. 70 (6): 816-822.

[14] T. Sugiyama, J. Francis, N. J. Middleton, N. Owen, B. Giles-Corti: Associations between recreational walking and attractiveness, size, and proximity of neighborhood open spaces. 2010, Am J Public Health. 100 (9): 1752-1757.

AUTHORS

Sumardi basri – Lecturer, Forestry Study Program, Faculty of Forestry, Malang Institute of Agriculture, Email: sumardibasri71@gmail.com
Amin Setyo Leksono – Associate Professor, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya. Email: amin28@ub.ac.id
Bagyo Yanuwiadi – Assistance Professor, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya. Email: yanuwiadi60@yahoo.co.id

Corresponding author – Amin Setyo Leksono, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya, Jl. Veteran, Malang, Jawa Timur, Indonesia, 65145. Phone: +62-341-575841, Fax: +62-341-554403. Email: amin28@ub.ac.id